

**RESULTS OF OCTOBER 1984 PUMP
TESTS AT YOSEMITE WEST**

**prepared for
Raymond Vail and Associates
Sonora, California**

by

**Kenneth D. Schmidt
Fresno, California**

November 1984



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December 4, 1984

Mr. Ted Pederson
Raymond Vail & Associates
27 South Shepherd Street
Sonora, California 95370

Re: Yosemite West Pump Tests

Dear Ted:

Submitted herewith is my report on the recent pump tests conducted at Yosemite West. I appreciate the cooperation of your firm during the testing program.

Sincerely yours,

Kenneth Schmidt
Kenneth D. Schmidt

KDS:kt

RESULTS OF OCTOBER 1984 PUMP
TESTS AT YOSEMITE WEST

Introduction

Schmidt (1982) described groundwater conditions at Yosemite West in a comprehensive report. Recommendations on potential areas for future development of groundwater were included in this report. Pursuant to these recommendations, Yosemite West contracted for the drilling of six hardrock test wells during June 1982. Johnson Drilling Company, Inc. of Reedley drilled the wells by the air-rotary method. Two of these wells were drilled near the confluence of West Creek and Indian Creek, which is considered the most favorable area at Yosemite West in terms of potential for development of groundwater. One of these wells (Well C) encountered about 30 gpm of water, based on a short-term air test at the time of drilling. New Well No. 9 is located about 220 feet from Well C. This well was drilled in 1980 but never pump tested to determine the long-term yield. Well No. 9 reportedly produced over 100 gpm on the short term. It was decided to pump test both of these wells in October 1984. Because these two wells are in close proximity to another well (No. 11) that had previously been pump tested, it was necessary to pump all three wells simultaneously in order to determine their respective long-term yields.

Well Data

Well No. 11 is located within 100 feet and east of West Creek. This well was drilled in 1972 by Anderson Pump Co. of

Chowchilla, utilizing the cable-tool method. Well No. 11 is reportedly 57 feet deep, with 8-inch and 12-inch diameter casing installed. The well casing is reportedly perforated from 15 to 56 feet in depth. Based on presently available information, Well No. 11 primarily tapped weathered materials overlying the hardrock. A ten-day pump test was conducted on the well in May 1972, and Schmidt (1982) estimated that the long-term yield would be about 21 gpm based on the results of that test.

New Well No. 9 was drilled by Jack Carroll Drilling, Inc. of Sonora in September 1980. It is located 105 feet northeast of Well 11. Weathered granitic rocks were reported to a depth of 78 feet, and fractured granitic rocks to a depth of 325 feet. About 70 gpm of water were encountered in a fracture at a depth of 101 feet, and another 30 gpm in a fractured zone between 130 and 132 feet in depth. Small amounts of water were reported at depths of 190 to 200 feet and 300 to 305 feet. Thus almost all of the water from this well is derived from above a depth of 135 feet. A six and five-eighths inch diameter casing was installed to a depth of 80 feet, and an annular seal placed to that depth. The well was reportedly test pumped for 48 hours at a rate of 105 gpm in September 1980.

Well C was drilled by Johnson Drilling Company, Inc. to a depth of 300 feet. It is located 250 feet south of Well No. 11 and 220 feet southwest of New Well No. 9. Weathered granitic rocks were reportedly penetrated to a depth of 61 feet, and fractured granitic rocks were penetrated to the bottom of the hole. Most of the water production reportedly came from 85 to

111 feet and 140 to 170 feet in depth. A small amount of water was produced from 203 to 239 feet in depth. The major water-bearing zones are approximately at the same depths as for New Well No. 9. Well C was equipped with 62 feet of seven-inch diameter casing, and an annular seal installed to 50 feet in depth.

Two additional wells were used as observation wells during the test. Old Well No. 6, located 10 feet west of Well No. 11, was reportedly drilled in September 1971 by Bannon Drilling of Oakhurst to a depth of 30 feet. It was equipped with three feet of six and five-eighths inch diameter casing. Old Well No. 6 only taps the upper part of the weathered materials tapped by Well No. 11. This well was reported to produce an insignificant amount of water when airtested at the time of drilling. New Well No. 6 was drilled by Jack Carroll Drilling in September 1980 to a depth of 200 feet. It is located about 800 feet east of New Well No. 9. It was equipped with 80 feet of six and five-eighths inch diameter casing, and also reportedly yielded an insignificant amount of water during airtesting at the time of drilling.

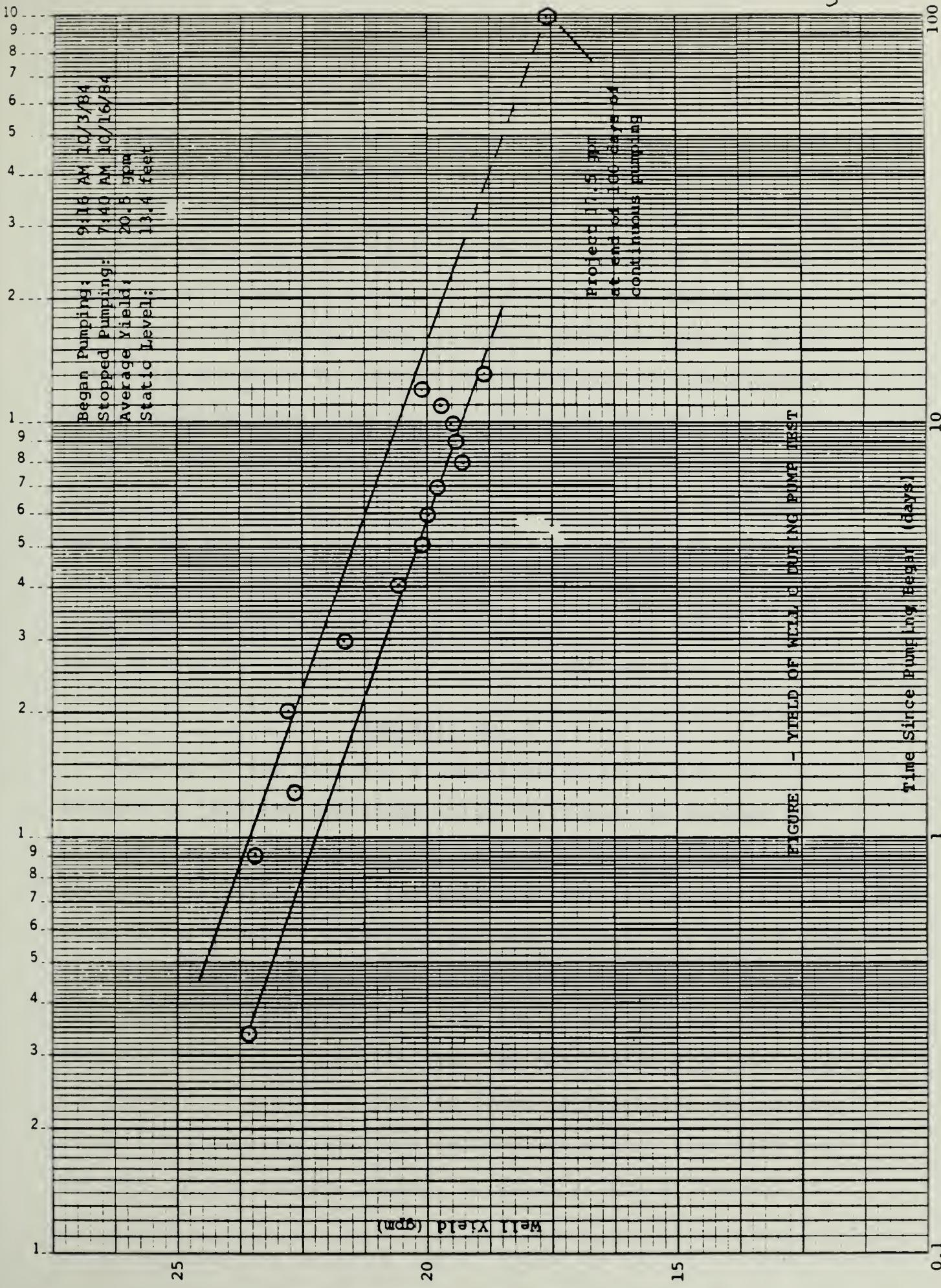
Methodology for Pump Tests

The pumping rate in each of Wells No. C and 11 was measured with a one-inch diameter Rockwell totalizing flowmeter. The pumping rate for New Well No. 9 was measured with a two-inch Rockwell totalizing flowmeter. Both meters had been calibrated prior to the pump test. Depth to water in the pumped wells was measured inside specially installed access tubes, with Powers

two-line electric sounders. The water from each well was piped to Indian Creek, so as to not influence the test results. Both Indian and West Creeks were flowing at the time of these pump tests. Depth to water and well yield were measured frequently during the early parts of the drawdown and recovery tests, and less frequently thereafter. Procedures generally followed those specified by the County of Fresno in Section II-H of the subdivision ordinance.

Well C

The pump in Well C was installed to a depth of 275 feet. Depth to water was 13.4 feet prior to pumping. Pumping commenced at 9:16 a.m. on October 3, 1984 and continued until 7:40 a.m. on October 16, or about thirteen days. A total of 380,900 gallons of water was pumped from the well, at an average rate of 20.5 gpm. The initial pumping rate was about 40 gpm, but by the end of several hours of pumping, the rate had fallen to about 25 gpm. Near the end of the test, the well was pumping about 19 gpm. Figure 1 shows pumping rate plotted against the logarithm of pumping time. Depth to water was kept about 140 to 160 feet deep throughout most of the test. Well yields were about 1 gpm greater when the water level was deep (i.e. 160 feet), as opposed to shallow (i.e. 140 feet). Considering the depth of water-producing zones in the well, the higher rates are more valid for determining long-term yield. It is projected that Well C would pump about 17.5 gpm at the end of 100 days of continuous pumping under these conditions. However, at a uniform pumping rate, which is more advisable,

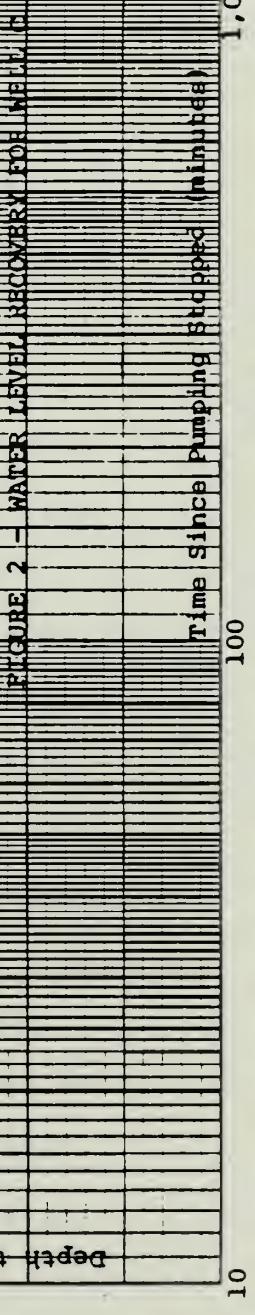


the well could produce about 19 gpm for 100 days of continuous pumping.

Figure 2 shows water-level recovery for Well C. The water-level recovery was rapid for this well, and within one hour the depth to water was 25.0 feet. After four hours of recovery, depth to water was 22.9 feet, or 9.5 feet below the static level prior to pumping. Due to access problems because of heavy precipitation on October 16, no further recovery measurements could be made until October 22. After six and one-third days of recovery, depth to water was 15.9 feet, or only 2.5 feet below the static level prior to pumping. There was no indication that the heavy precipitation affected the rate of recovery. The water level in Well C thus showed a good recovery. Uncorrected recovery measurements for Well C indicate an aquifer transmissivity of 1,400 gpd per foot.

New Well No. 9

Pumping of New Well No. 9 commenced at 12:45 p.m. on October 3, 1984 and continued until 10:10 a.m. on October 15, or about twelve days. The pump was installed to a depth of 150 feet in this well. Depth to water was 19.2 feet prior to pumping. A total of 1,806,500 gallons of water was pumped from this well, at an average rate of 105 gpm. The initial pumping rate was about 140 gpm, and by the end of one day the pumping rate had fallen to about 124 gpm. On the second day, the rate was reduced to about 110 gpm, in order to stabilize the pumping level. The pumping rate then declined at a very slow rate for the rest of the pumping period, to about 97 gpm at the end of



Static Level: 13.4 feet
 Average Yield: 20.5 gpm
 Stopped Pumping: 7:40 AM 10/16/84

the test (Figure 3). It is projected that the pumping rate, after 100 days of continuous pumpage under these conditions, would be about 87 gpm. At a uniform pumping rate which would be more advisable, the well could produce about 93 gpm over a 100-day pumping period.

Figure 4 shows selected depth to water measurements during the first few days of pumping. Measurements for the period from about 70 to 1,400 minutes were used to determine an aquifer transmissivity of 4,200 gpd per foot. This relatively high value for fractured granitic rocks explains the high pumping rates maintained by New Well No. 9 during the test. After a reduction in pumping rate at 7:30 a.m. on October 5, the water level was kept between 135 to 150 feet deep for the remainder of the test. This depth range is below the major water-producing zones in the well.

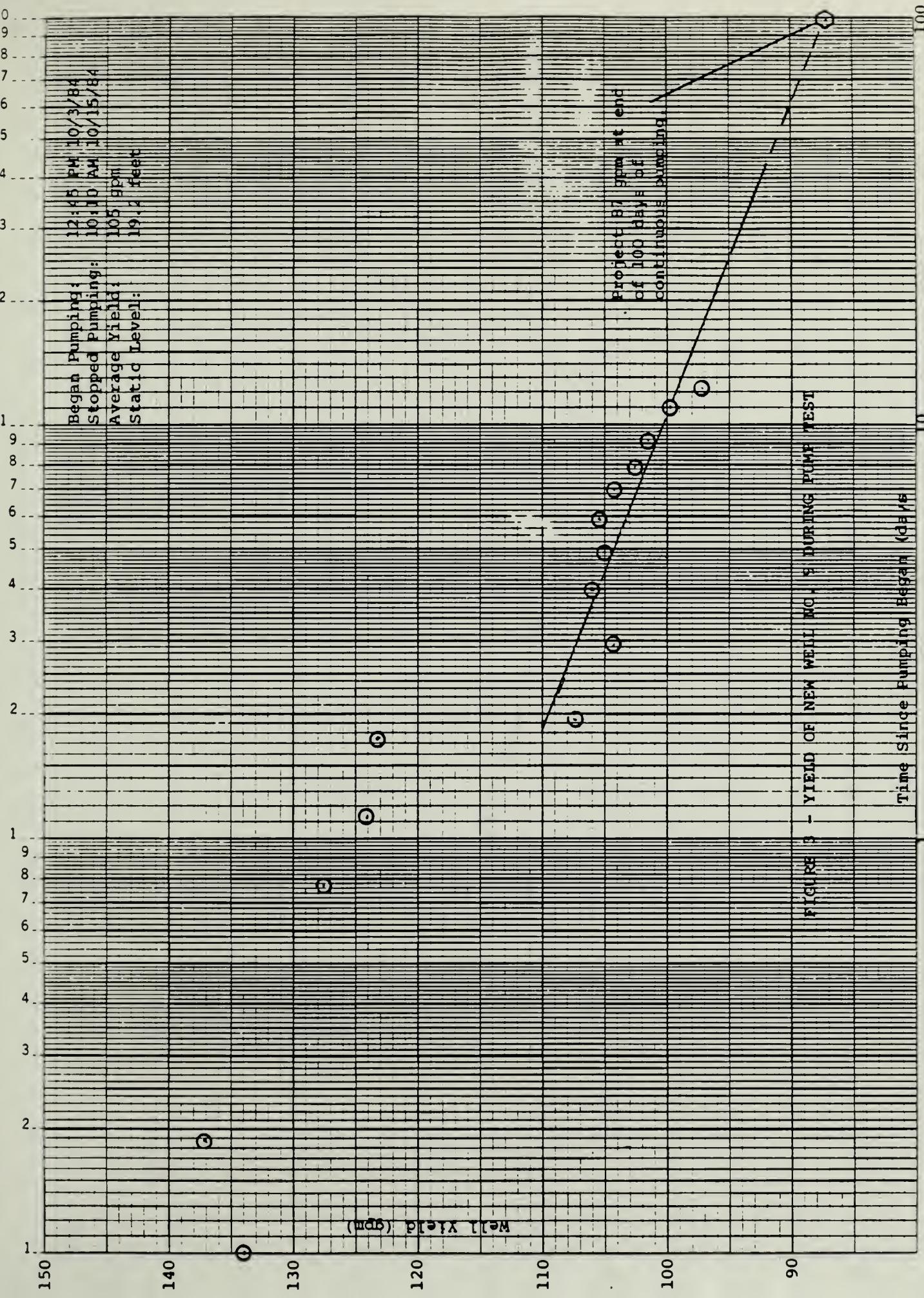
Water-level recovery was measured frequently for about one day after pumping stopped (Figure 5). The measuring point (top of casing) for the measurements shown in Figure 5 was 1.53 below that (top of access tube) used for the drawdown measurements. Values for depth to water discussed in this paragraph have been corrected, so as to coincide exactly with the elevation of the measuring point used for the drawdown measurements. Depth to water was 31.8 feet after one day of recovery. Due to the access problems after October 16, which were described previously, the water level could not be measured again until October 22. After slightly more than seven days of recovery, depth to water was 25.5 feet, or 6.3 feet below the static level prior to pumping. Projections indicate that full

Began Pumping: 12:15 PM 10/3/84
 Stopped Pumping: 10:10 AM 10/15/84
 Average Yield: 105 gpm
 Static Level: 19.2 feet

Project 87 EPM at end
 of 100 days of
 continuous pumping

FIGURE 3 - YIELD OF NEW WELL NO. 2 DURING PUMP TEST

Time Since Pumping Began (days)



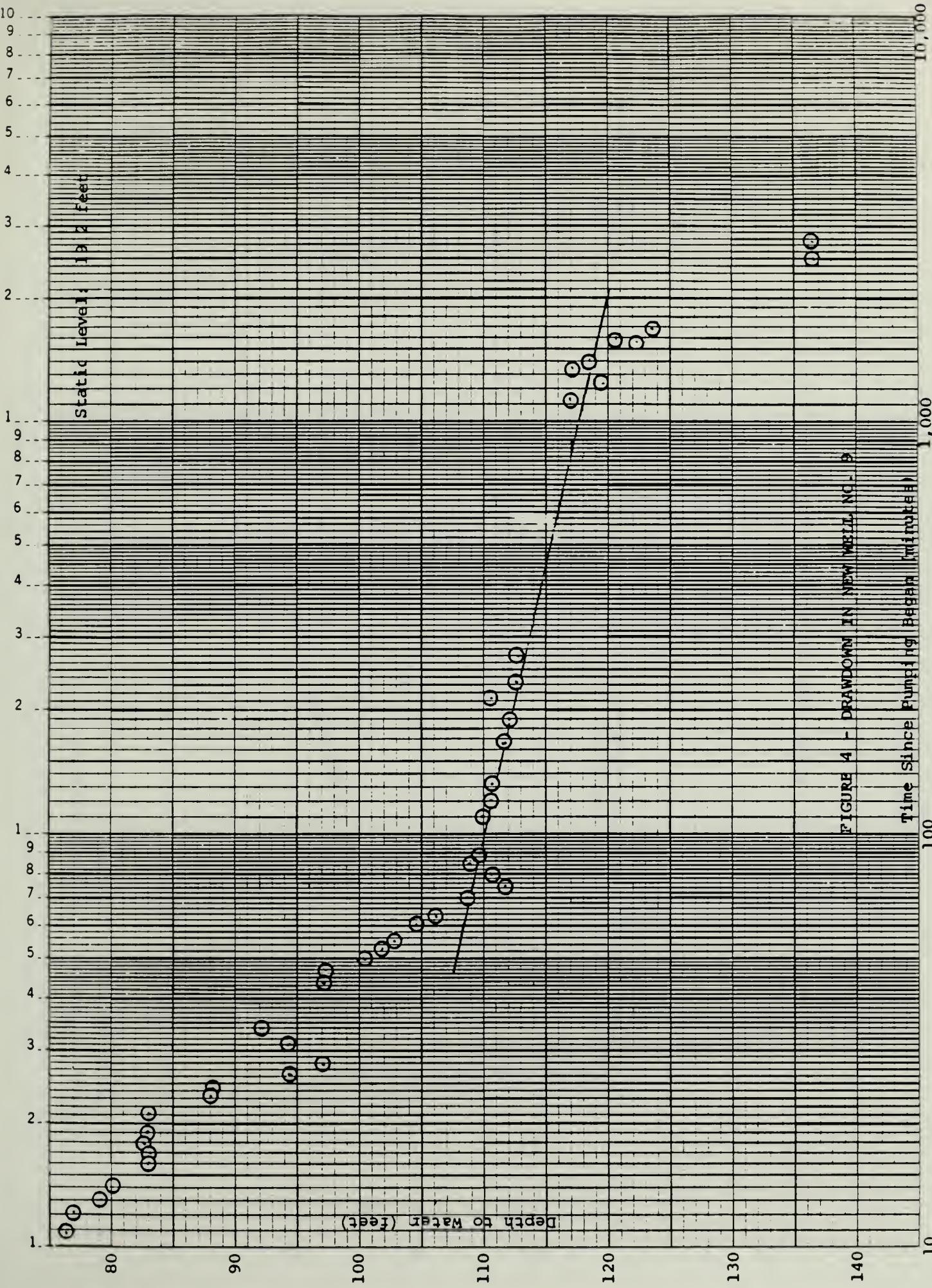


FIGURE 4 - DRAWDOWN IN NEW WELL NC-9

Pumping Stopped: 10:10 AM 10/15/64
Average Yield: 105 gpm
Static Level: 19.2 Feet

20

40

60

80

Depth to Water (Feet)

Time since Pumping Stopped (minutes)

1,000

10,000

Note: The M.P. for these measurements
was 1.53' below the for drawdown
measurements.

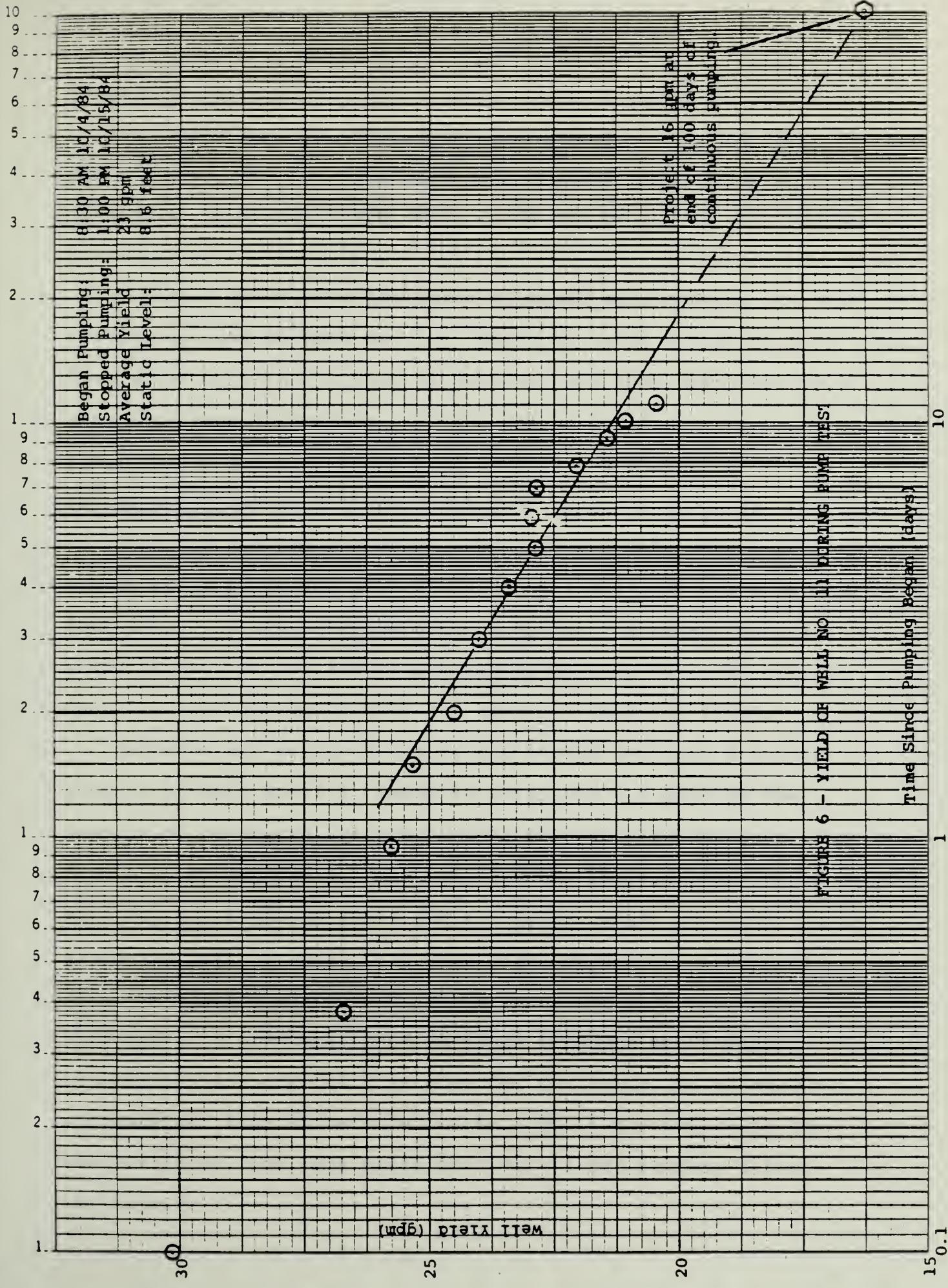
FIGURE 5 - WATER LEVEL RECOVERY FOR NEW WELL NO. 9

recovery would probably be attained within about one month after pumping stopped. Recharge from the heavy precipitation did not influence the recovery measurements. Transmissivity, determined from uncorrected recovery measurements, was 3,700 gpd per foot, in good agreement with the value determined from the drawdown measurements.

Well No. 11

The test pump was set to a depth of 50 feet in Well No. 11. Well discharge was measured with a Rockwell one-inch totalizing flowmeter. Pumping began at 8:30 a.m. on October 4, 1984 and continued until 1:00 p.m. on October 15, or slightly more than eleven days. Water levels measured in Well No. 11 during October 3 indicated that pumping of New Well No. 9 exerted an influence on depth to water in Well No. 11. Depth to water in Well No. 11 was 8.6 feet on the morning of October 3, prior to pumping of New Well No. 9, and had fallen to 11.9 feet by the morning of October 4. This indicates that the shallow fractures tapped by New Well No. 9 are hydraulically connected to the weathered zone tapped by Well No. 11.

A total of 373,300 gallons of water was pumped from Well No. 11 during the test, at an average rate of 23.2 gpm. Figure 6 shows the pumping rate plotted against the logarithm of pumping time for Well No. 11. The initial pumping rate was about 34 gpm, and the pumping rate declined to about 30 gpm after several hours of pumping. The rate then gradually declined during the remainder of the test, to about 20.5 gpm at the end of the test. Based on these measurements, it is

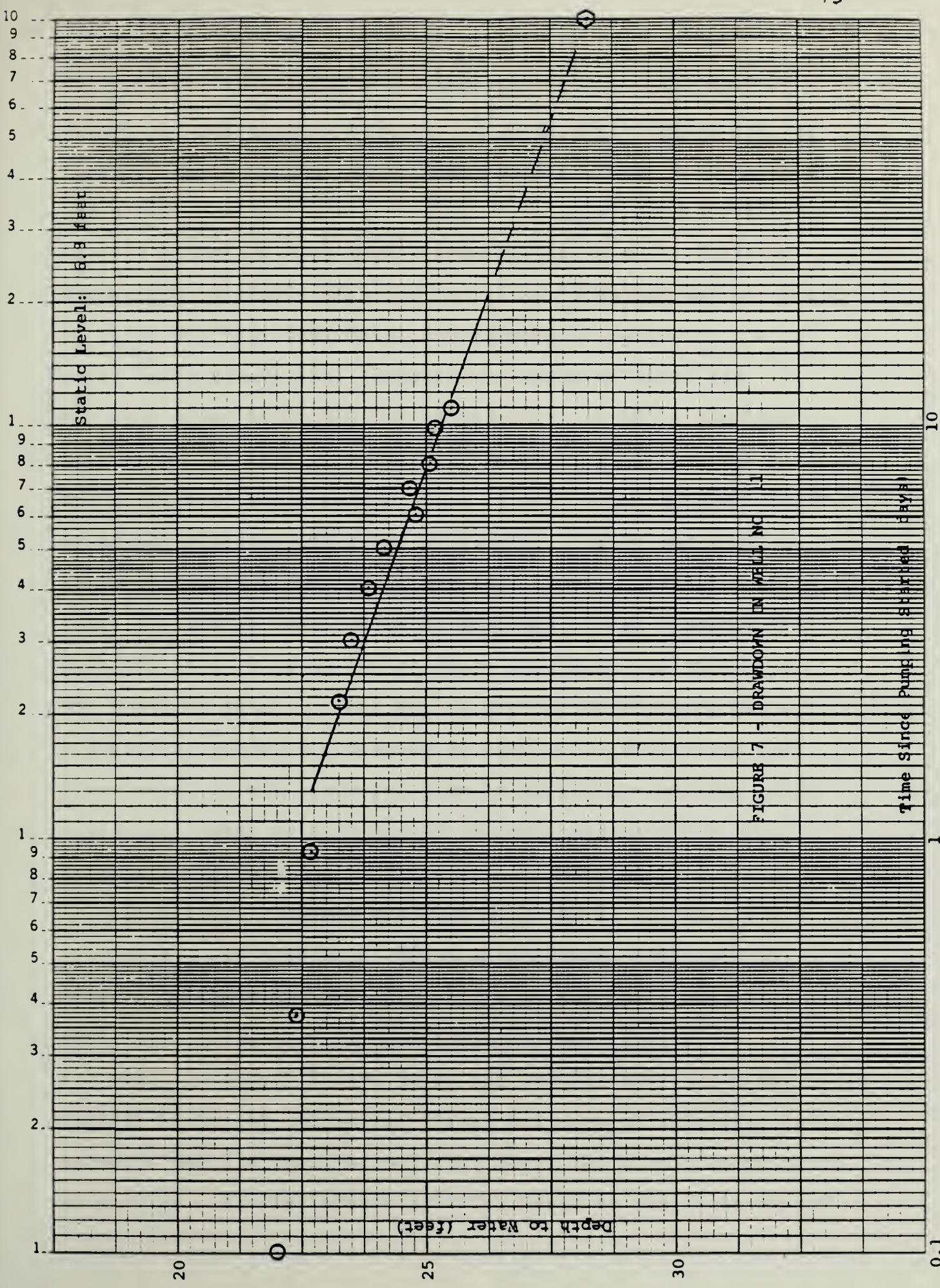


projected that the well would yield about 16 gpm after 100 days of continuous pumping under these conditions. The long-term yield of Well No. 11, if pumped at a uniform rate which is advisable, would be 18 gpm (over a 100 day period of continuous pumping).

Figure 7 shows selected depth to water measurements for the eleven day test on Well No. 11. Depth to water was about 21.5 feet after only ten minutes of pumping, and then increased at a very slow rate thereafter. At the end of the test, the pumping level was 25.5 feet. Using 11.9 feet as the static water level, the drawdown was thus 13.6 feet, and the specific capacity was 1.5 gpm per foot. Based on the pump test measurements, it is projected that the pumping level would be about 28 feet after 100 days of continuous pumping. Drawdown measurements in Well No. 11 indicate a transmissivity of 2,020 gpd per foot, in good agreement with the specific capacity value.

Drawdown was measured frequently in Old Well No. 6 during pumping of Well No. 11. Depth to water was 4.0 feet on the morning of October 3, before pumping of any well commenced. At 8:26 a.m. on October 4, just prior to the start of pumping of Well No. 11, depth to water was 4.8 feet. Depth to water gradually fell to about 11.0 feet after four days of pumping Well No. 11, and at the end of the test, depth to water was 15.6 feet. A graphical plot of these drawdown measurements indicates that they can't be used for determination of aquifer parameters. This is because Old Well No. 6 doesn't fully tap the weathered zone from which Well No. 11 was pumping during the test.

FIGURE 7 - DRAWDOWN IN WELL NO. 1



Recovery measurements for Well No. 11 are shown in Figure 8. The measuring point for these measurements (top of casing) was 2.88 feet below that (top of access tube) used for the drawdown measurements. Water-level measurements discussed in this paragraph have been corrected, so as to be directly comparable to levels measured during the drawdown period. Depth to water was 14.1 feet after ten minutes of recovery, and the water level slowly rose thereafter. Depth to water was 8.1 feet after about one day of recovery, or about one-half foot above the static level prior to pumping. After October 16, no further measurements could be made until October 22, due to access problems described previously. After one week of recovery, depth to water was 6.5 feet, or more than two feet above the static level prior to pumping. These measurements indicate that recharge due to heavy precipitation influenced the depth to water in Well No. 11 during the recovery period. A hydraulic connection between streamflow in West Creek and groundwater in the weathered zone is apparent. Aquifer transmissivity, based on uncorrected recovery measurements, was 3,000 gpd per foot.

Water-level recovery was also measured in Old Well No. 6 (Figure 9). In this case, these measurements corresponded closely to those for Well No. 11 during the first day of recovery. Depth to water after one day of recovery was 4.2 feet, or only 0.2 feet below the static level prior to pumping of any of the wells. After one week of recovery, depth to water was 3.4 feet, or 0.6 feet above the static level prior to pumping. Aquifer transmissivity, based on the first day of

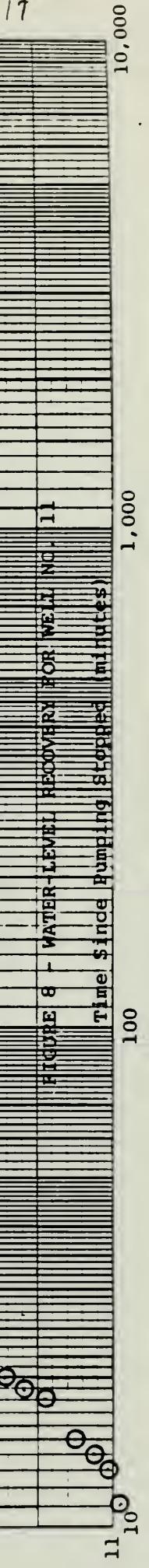
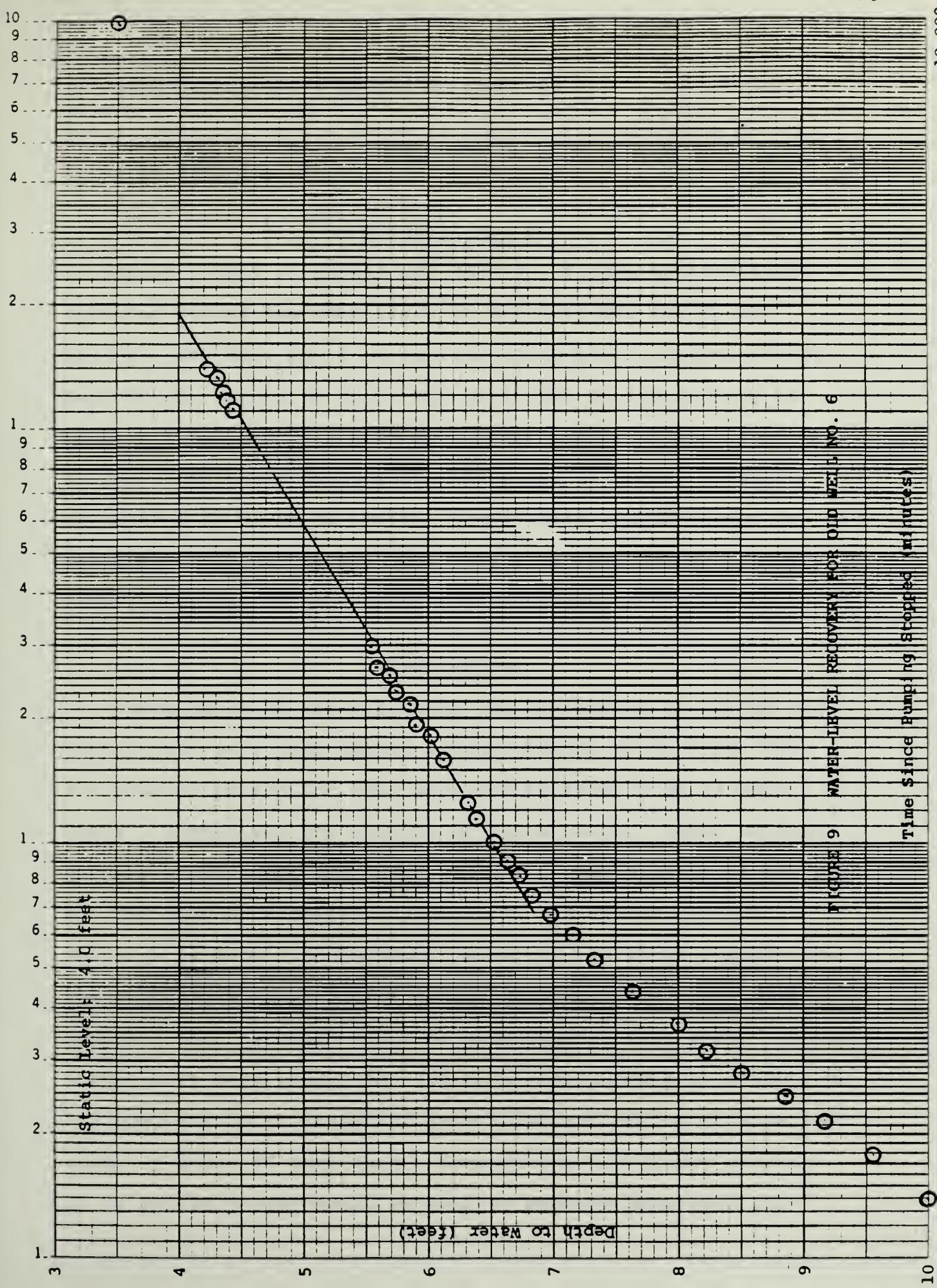


FIGURE 9 WATER-LEVEL RECOVERY FOR OLD WELL NO. 6

Time since Pumping Stopped (minutes)

Static Level: 4.0 feet

Depth to Water (feet)



recovery measurements in Old Well No. 6, was 3,000 gpd per foot, identical to the value determined from recovery measurements on Well No. 11.

New Well No. 6

Water levels in unused New Well No. 6 were periodically measured during the pump tests on Wells C, New No. 9, and No. 11. New Well No. 6 is located about 800 feet east of New Well No. 9. Depth to water was 23.1 feet on the morning of October 4 and was 23.4 feet on the morning of October 15. This slight water-level decline is likely due to normal seasonal variations in depth to water. Water-level measurements in New Well No. 6 during the pump test thus indicate no significant effect due to pumping of the three wells.

Conclusions

Three wells in the area near the confluence of Indian and West Creeks were pump tested simultaneously in October 1984. The pumping period for each well ranged from 11 to 13 days. Table 1 summarizes the results of these tests. Under uniform pumping conditions, the three wells can pump a total of 130 gpm for 100 days of continuous pumping in the summer months. Recharge is more than adequate to supply the water pumped from these wells. Schmidt (1982) estimated that up to 1,000 acre-feet per year of water could be developed in that area. If the three wells were pumped for 100 days continuously at a total of 130 gpm, the total amount of water produced during this period would be about 57 acre-feet. Considering non-summer pumping, it is unlikely they would be used to produce more than 100

TABLE - RESULTS OF OCTOBER 1984 PUMP TESTS AT YOSEMITE WEST

	<u>Well</u>	<u>C</u>	<u>New No. 9</u>	<u>No. 11</u>
Static Water Level (feet)		13.4	19.2	8.6
Duration of Pumping (days)	13	12	11	
Pumping Rate at End of Test (gpm)	19	97	20.5	
Average Pumping Rate (gpm)	20.5	105	23.2	
Final Pumping Level (feet)	146	135-150		25.5
Projected Yield after 100 days at Maximum Pumping Rate (gpm)	17.5	87	16	
Projected Yield after 100 days at Uniform Pumping Rate (gpm)	19	93	18	
Transmissivity (gpd per foot)	1,400	4,000	2,500	

acre-feet of water on an annual basis, which is well below the amount of recharge available.

REFERENCE

Schmidt, K.D., 1982, "Groundwater Conditions at Yosemite West," prepared for Yosemite West, 16 p.

